

[0100] 6. Transmission starts in mode 3 using the selected 22 MHz band.

[0101] Example results of the PLS procedure applied to the exponentially fading IEEE 802.15.3 channel for a delay spread of 25 ns. are shown in FIG. 23 wherein the 79 MHz channel is sampled at a 5 MHz spacing. As shown, the 5 MHz spacing can identify good 22 MHz contiguous bands in the 79 MHz bandwidth. The 1, 5, 22 and 79 MHz parameters described above are of course only exemplary; other values can be used as desired. As one example, rather than hopping on 1 MHz channels, the system could hop over different bandwidth channels (e.g. a 22 MHz channel) and transmit data occupying the whole channel.

[0102] FIG. 21A diagrammatically illustrates pertinent portions of an exemplary embodiment of the mode controller of FIG. 19A. The embodiment of FIG. 21A includes a probe and selection controller 211 which outputs to the mode 1 transceiver section 197 information indicative of the frequencies on which the probe and selection packets are to be transmitted, and can also provide the probe and selection packets to the mode 1 transceiver section 197, depending upon whether the probe portion or the select portion of the above-described PLS operation is being performed. A band quality determiner 212 receives conventionally available correlation values from the mode 1 transceiver section 197 and determines therefrom band quality information which is provided at 215 to a band selector 213. The band quality information 215 can include, for example, any of the above-described quality parameters. The band selector 213 is operable in response to the quality information 215 to select the preferred frequency band for mode 3 communications. For example, the band selector 213 can use any of the above-described band selection criteria. The band selector 213 outputs at 216 to the probe and selection controller 211 the index of the lowest frequency of the preferred frequency band. The probe and selection controller 211 includes the received index in the selection packets that it provides to the mode 1 transceiver section 197 for transmission to the other transceiver involved in the PLS operation.

[0103] The mode controller of FIG. 21A also includes a frequency band mapper 214 which receives selection packets from the other transceiver involved in the PLS operation. The frequency band mapper extracts the index from the selection packets and determines therefrom the selected 22 MHz frequency band. Information indicative of the selected frequency band is output from the frequency band mapper 214 to the mode 3 transceiver section 198, after which mode 3 communication can begin.

[0104] FIG. 21B illustrates exemplary operations which can be performed by the transceiver of FIGS. 19A and 21A. At 221, the aforementioned parameters  $n$ ,  $k$ ,  $T_1$ ,  $T_2$  and  $T_{PLS}$  are determined, for example, during initial handshaking. At 222, the transceiver operates in mode 1 for a period of time equal to  $T_1 - T_{PLS}$ . Thereafter, at 223,  $n$  probe frequencies within the available bandwidth (BW) are determined, and a probe packet is transmitted on each probe frequency at 224. At 225, the probe packets are received and corresponding frequency channel quality information (for example maximum correlation values) is obtained. At 226, the frequency channel quality information is used to produce band quality information, and the band quality information is used at 227 to select a preferred frequency band for mode 3 communi-

cation. At 228,  $k$  selection packets are transmitted on  $k$  different frequencies, each selection packet indicative of the selected frequency band. At 229, mode 3 communications are performed using the selected frequency band for a time period of  $T_2$ . After expiration of the time  $T_2$ , mode 1 communications resume at 222, and the above described operations are repeated.

[0105] FIG. 14B diagrammatically illustrates pertinent portions of a further exemplary embodiment of the mode controller of FIG. 19A. In the FIG. 14B embodiment, a modulation and coding mapper 141 receives at 142 from the band selector 213 (See FIG. 21A) the band quality information associated with the 22 MHz band selected during the PLS procedure. The modulation and coding mapper 141 maps the band quality information onto, for example, any of the exemplary modulation and channel coding combinations shown at 1-22 in FIGS. 14, 14A, 14C and 14D. At 143, the mapper 141 provides to the mode 3 transceiver section 198 information indicative of the selected modulation and channel coding combination. The mapping operation can be defined, for example, so as to maximize the system throughput given the band quality information of the selected band. In some exemplary embodiments, experimental simulation information similar to that shown in FIG. 13 above, for example, throughput versus band quality for different modulation schemes and also for different coding rates, can be used by the mapper 141 to select the combination of modulation scheme and coding rate that provides the highest throughput, given the band quality of the selected band.

[0106] Referring again to FIGS. 17 and 19, several packets can be transmitted from the master to the slave and vice versa in the time slot period  $T_2$  (e.g. 225 ms) allocated for mode 3. A nominal packet size of, for example, 200 microseconds can be used, as shown in FIG. 24. During their initial handshake, the master and the slave can, for example, agree on a certain number of packets to be sent in each direction. They can also agree (during the handshake) on the modulation scheme to be used in each direction.

[0107] In an example of one-way communications, and if ARQ (automatic repeat request) is used, the transmitting device can, for example, send a predetermined number of normal packets (also referred to herein as a superpacket). The number of normal packets in the superpacket can be agreed upon in initial handshaking. After receipt of the predetermined number of normal packets, the receiving device can, for example, send a short ARQ packet that is half the length of a normal packet. The ARQ packet can be preceded and followed by guard intervals (e.g. 100 microseconds). The ARQ packet serves to acknowledge the reception of the normal packets. Those packets whose CRC (cyclic redundancy code) did not check correctly are indicated in the ARQ packet. The transmitter can then send the requested packets again in a further superpacket. This procedure can be repeated until all packets get through or a time-out occurs. FIG. 24 shows an exemplary slot format for the case of one-way communication, either from master to slave (explicitly shown) or slave to master (not explicitly shown), with and without ARQ.

[0108] Two-way mode 3 communication from master to slave and slave to master can be handled similarly, as illustrated in the example of FIG. 24A.

[0109] ARQ and retransmissions are optional. Retransmissions can increase the mode 3 performance in the pres-